Saskatchewan Technology Enhancement Program

Preliminary Forest Cover Mapping for Caribou Habitat

by

John Polson
Saskatchewan Research Council

and

Mark E. Campbell
Saskatchewan Parks, Recreation and Culture
Prince Albert, Saskatchewan

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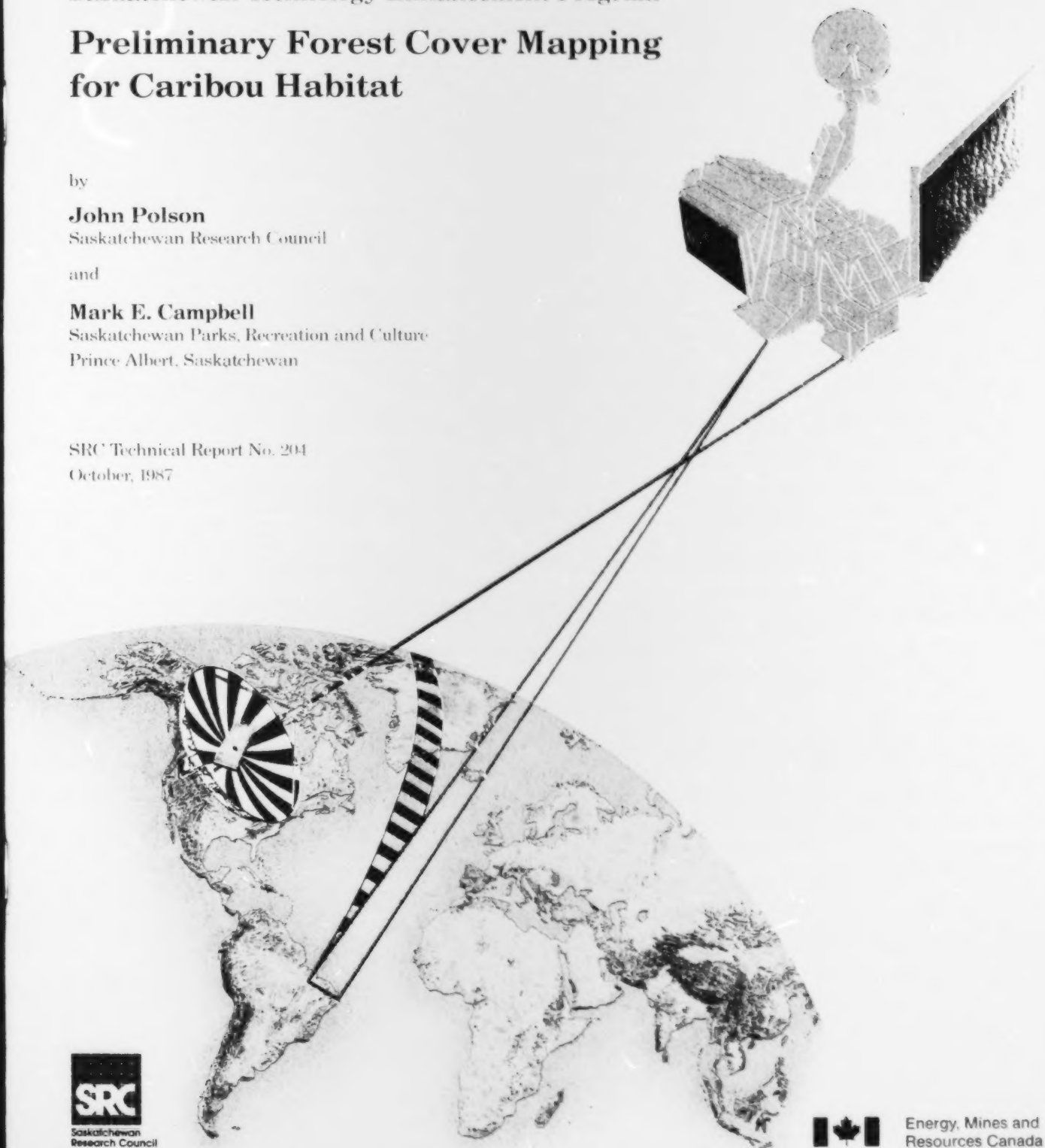

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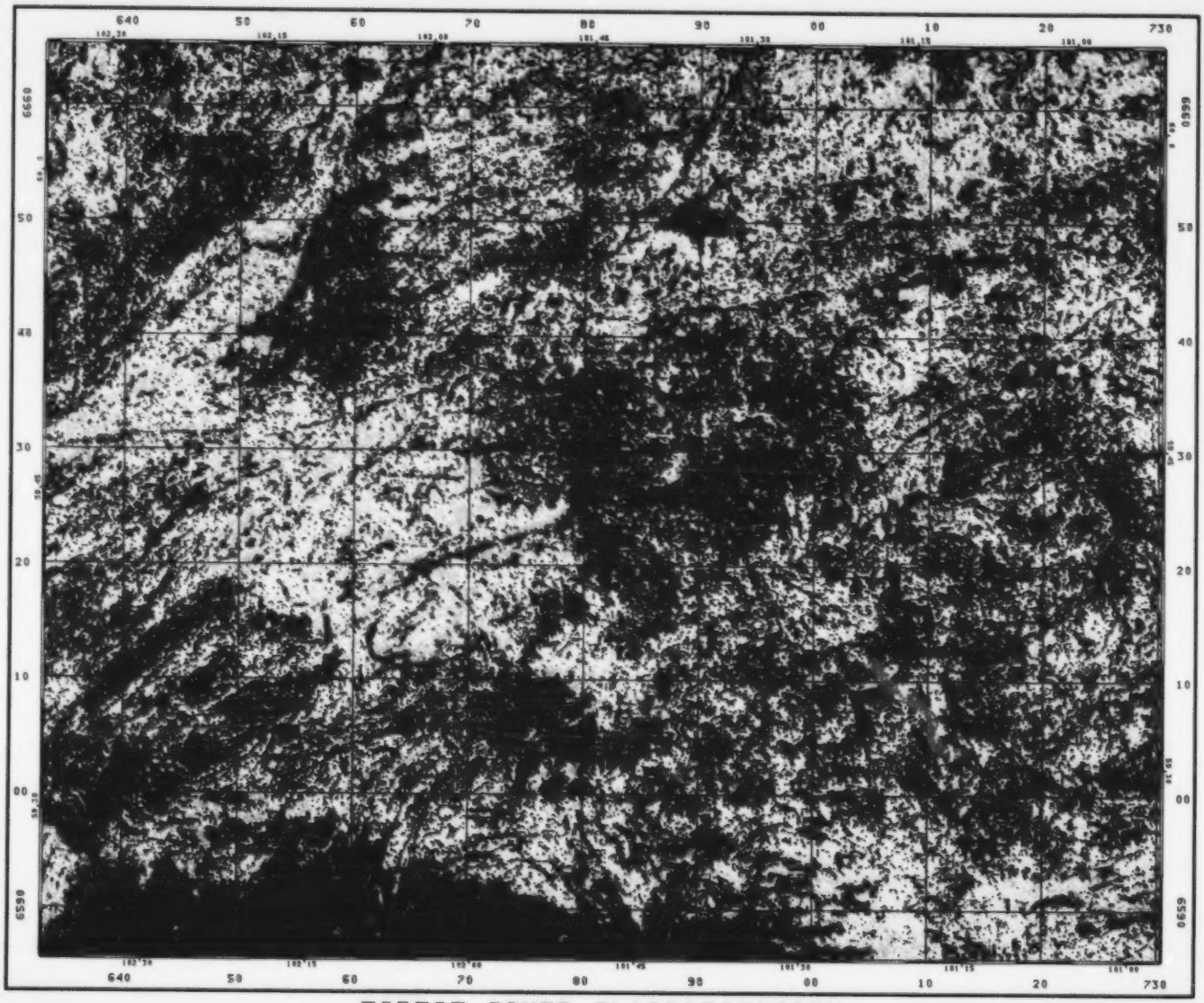

FOREST COVER CLASSIFICATION

CARIBOU HABITAT MAP - STONEY RAPIDS NTS 74N & O
LANDSAT IMAGERY AUG 17, 1984
J. POLSON, DOGR. RESEARCH COUNCIL - SEPT. 9, 1987

SCALE 1:250000

MILES 5 10 15 20
KILOMETERS 10 20 30

LAKES
SOFTWOODS
RECENT BURNS
MIXEDWOOD
BARE/TREED ROCK

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John Polson
Saskatchewan Research Council
Saskatoon, Saskatchewan

and

Mark Campbell
Saskatchewan Parks, Recreation and Culture
Prince Albert, Saskatchewan

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SUMMARY

Multi spectral digital data were used to produce a preliminary thematic map of a region in northern Saskatchewan frequented by wintering barren-ground caribou. Lack of recent air photo coverage or through familiarity with the region dictated use of the unsupervised classification algorithms in analyzing the data on a Dipix Aries digital image analysis system.

A preliminary vegetation cover colour map was produced with six cover classes.

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1. INTRODUCTION

As part of the Saskatchewan Research Council's (SRC) involvement in the Saskatchewan Technology Enhancement Program (STEP) a typical caribou winter habitat area in northeastern Saskatchewan was classified using Landsat multi spectral scanner (MSS) digital data. The project was conducted jointly by John Polson of SRC and Mark Campbell of Saskatchewan Parks, Recreation and Culture (SPRC), Forest Fire Management.

The region, northwest of Beaver Lodge Lake (Figure 1) was chosen after consultation with the Wildlife Branch of Saskatchewan Parks and Renewable Resources (SPRR; now Saskatchewan Parks, Recreation and Culture) (personal communication, T. Trottier, SPRR, 1984). Land cover maps at scales of 1:125,000 and 1:250,000 were considered suitable for use by biologists involved in managing the barren-ground caribou on their winter range.

Because cover data in the area was very limited, a decision was made to proceed recognizing that neither suitable aerial photography nor other forms of ground data were available or were unusable.

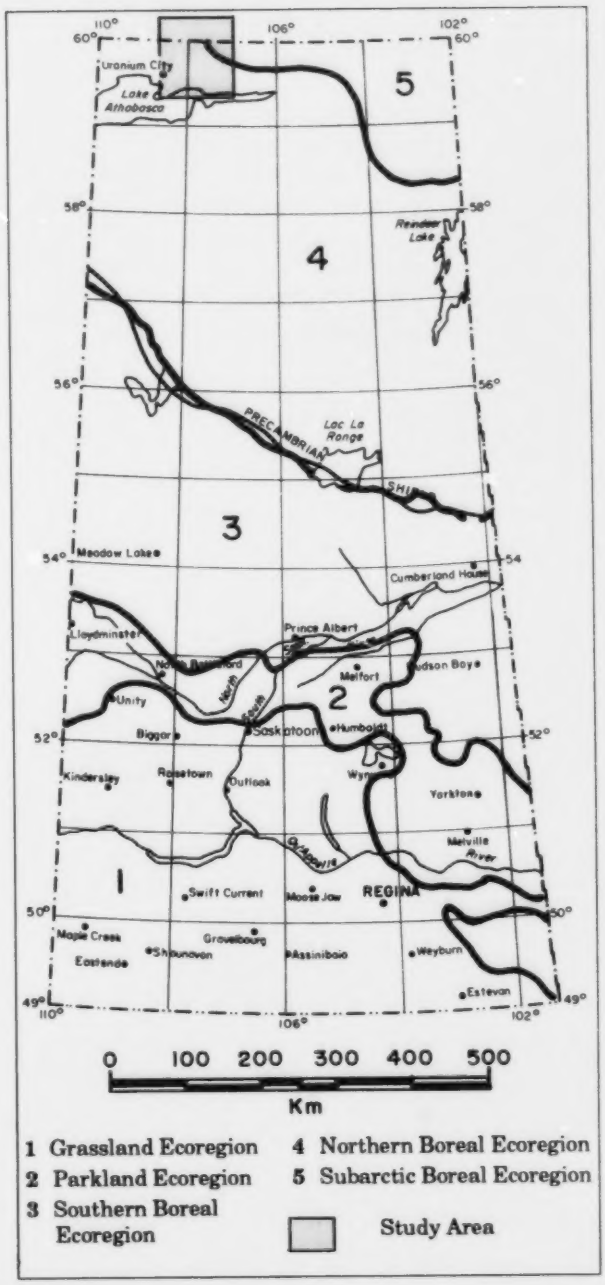

Figure 1. Location of the study area.

2. STUDY OBJECTIVE

The objective of the study was to produce a preliminary classification in thematic map form, suitable for use in the field during cover type reconnaissance.

3. STUDY AREA

3.1 Location

The study are lies between Longitude 10658 and 10837 Latitude (Figure 1). It extends from Lake Athabasca, north approximately 20 km into the Northwest Territories. Portions of the study area fall within the east half of map sheet 74N (Tazin Lake) and the western half of map 740 (Fond du Lac). The area encompasses hectares.

3.2 Physiography and Natural History

The study region is located within the Northern Transitional Zone of the Boreal Forest (Rowe 1972). Unfavorable climatic conditions, thin soils and frequent fires have combined to reduce the distribution, abundance and size of the tree species. Areas of bog, muskeg and bare rock are intermixed with open stands of dwarfed trees, although better growth occurs in sheltered areas where, deeper soils allow the more vigorous growth of woody vegetation. Black spruce (*Picea mariana*) is the most abundant tree species with some growth of white spruce (*Picea glauca*) on more favorable sites. Both alaska birch (*Betula neoalaskana*) and paper birch (*Betula papyrifera*) grow in boggy area and other poorly drained sites. Paper birch is also found on well drained sites. Both species of birch are common component of early forest regeneration after fire (Pers. comm. B. Godwin, SRC 1987).

The region supports a limited number of ungulates. Moose (*Alces alces*) occur in limited numbers. Barren-ground caribou (*Rangifer tarandus arcticus*) are found wintering in the region in most years (personal communication, T. Trottier, SPRR, 1984). In addition to theselarge mammals, the area supports a variety of other mammals and birds, many of which are characteristic of a subarctic region.

4. METHODS

4.1 Data Acquisition

A multi-spectral scanner (MSS) digital image in computer compatible tape (CCT) form was obtained from the Prince Albert Satellite Station. Microfiche were used to select up-to-date summer imagery with less than 5% cloud cover. In addition to the digital computer compatible tape, two 1:1,000,000 colour transparencies were used to provide some background information on the forest fires history. The dates and types of all image data obtained for the project are given in Table 1.

4.2 Reference and Ground Data

Air photo coverage of the region was not obtained at the time of the project. Limited knowledge of the area was available from field trips into the region.

4.3 Landsat Classification

Using a Dipix Ltd.- Applied Resources Image Exploration System (ARIES) - II[1] system a representative area was appended from the large image and geometrically corrected to the Universal Transverse Map (UTM) grid system.

An unsupervised algorithm was used to classify the region. Histograms of the four MSS bands were displayed and searched for local maxima peaks. Close to the maximum allowable number (32) peaks were ranked by mean and standard deviation. The maxima were then merged into clusters based on their associated similarities.

Four smaller test areas were chosen on which to perform a preliminary classification representative of reflectance differences within the image. A standard maximum likelihood classifier was performed on the subimages.

The resulting classification for each subarea was interpreted allotting the appropriate classes to cover types. Comparisons were made between each subarea description.

Maxima from all classes which pertained to the same cover type were combined and new signature files generated.

The test classifications to this point had left small water bodies unclassified. Additional water training areas were therefore added using the supervised classification task and the resulting signature file was combined with the water-related portions of the unsupervised classification.

Table 1.
List of Imagery Used in the Study Area.

Track & Row	Image Date	Landsat	Product	Scale
44/18	July 6, 1984	3	MSS computer tape	-
44/18	June 6, 1974	1	Colour transparency	1:1,000,000
44/18	July 6, 1977	2	Colour transparency	1:1,000,000

1) Mention or failure to mention commercial trade names doses not imply endorsement or criticism by the Government of Canada or the Government of Saskatchewan.

A final check of the signature files was made by running the maximum likelihood classifier on several new subareas. After that the classification was judged to be acceptable, the signature files were used to classify the entire image.

A post classification filter was performed on the theme classes. The most significant change created by post filtering was in the water and burn classes. As a result of unsupervised classification, both themes had a speckled appearance. The post filter removed the non-lake and non-burn areas and replaced them with the appropriate theme.

5. RESULTS

A thematic map of the six cover classes was produced. The areal extent of each class is also given in Table 2. Five percent of the area remained unclassified.

Verification of the map, indicated general agreement between the thematic map and known cover types. A formal accuracy assessment is currently underway.

Table 2.
Calculated Area and Percent Occurrence of Six Cover Types.

	Hectares	Percent Total Area
Water bodies	66,997	17.3
Softwood dominant forest	87,627	22.7
Recent burns	30,407	7.9
Mixedwood forest	50,293	13.0
Bare and treed rock	106,339	27.5
Hardwood dominant forest (and bog)	25,692	6.6
Unclassified	19,501	5.0
Total	386,856	100.0

6. CONCLUSIONS

Unsupervised classification is a useful tool for the creation of preliminary cover maps prior to field visits in areas where little existing information or data are available. A thematic map can provide the basis for ground data collection improving the investigators field efficiency.

This project allowed the researcher to explore the utility of the unsupervised classification algorithms available on the ARIES digital analysis system. Operator interaction with the program throughout the classification process allowed the researcher to make use of limited knowledge of the area and improve the results of a final classification over results which would be obtained if the entire process was left up to decision making process built into algorithms developed for unsupervised classification.

No follow up project has been planned, however experience gained in this project is now being used on a day to day basis with other cover mapping projects.

7. LITERATURE CITED

Rowe, J.S. 1972. *Forest Regions of Canada.* Department of Environment, Canadian Forestry Service. Public No. 1300. 172 pp.